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A PHASE OF THE PROBLEM OF CONTINGENCY

THE aim of this paper is to discuss a phase of the very old problem of contingency; not the contingency of the acts of the individual man as such, but one sub-case of what might be called cosmic contingency. The precise problem will, I hope, be made clear as we proceed.

On the one hand, it is desired to admit and use universal natural law, but on the other to find, if possible, an escape from the *nec quando nec ante nec post, sub specie æternitatis* point of view which Spinoza took to be the logical outcome of his determinism. It is desired in this paper to accept determination in the fact of eventuation, but not before that fact. In other words, the writer objects to the position that determination, definite and final, exists antecedent to the act of eventuation. His thesis is that such determination antecedent to the fact is shown only for a closed situation, a finite universe; and that, accordingly, the logical process whereby the mind has historically gone to a universal and all-inclusive system of antecedent determination is blocked, if the actual universe be conceived as quantitatively infinite.

The program as stated is a problem of ethics or perhaps more exactly of philosophy as philosophy essays to mediate in the conflict between a certain extension of physical science on the one hand and an apparently essential demand of ethics and practical life on the other. But, although the problem is philosophical, the discussion will be more scientific, because the writer believes that the assertion of the above-mentioned extension of law is scientifically neither necessary nor justifiable.

One who fixes his attention on natural scientific explanation easily becomes so enamored of the certainty with which "effect" follows "cause" as to feel that in this uniform and invariable succession there does lie and must lie the key to "the riddle of the universe." At least so far as the riddle can properly be put for solution, and so far as a key may wisely be sought. Especially does this key appear to be the true and only one in proportion as it enables the student of nature to foretell future eventuation, whether in the artificially devised experiment of the laboratory or in the observation of naturally occurring phenomena. This line of thought might be developed somewhat as follows.

If it be true that each event finds its entire character determined exactly by previous events, then a knowledge of those previous events and the general operations of nature would enable us to foretell exactly the entire character of the event in question. We do not now ask whether human ability shall ever be equal to such a task; the present point is that the character of the event is completely determined in advance of eventuation, and, under certain ideal, even if unattainable, conditions, could have been foretold. Any event that is thus exactly determined by a set of conditions is *actually* determined as to both its character and occurrence as soon as the determining conditions are themselves exactly and exclusively determined, and this is true even though time must elapse before the determined event becomes actual. In this sense the event may be said to exist potentially in its determining conditions. If, then, the state of affairs S_2 exists thus potentially in the state of affairs S_1 and S_3 similarly in S_2, does it not also follow that S_3 exists in the same way in S_1, and so for all succeeding S's? That is, this line of reasoning seems to make us conclude that in the present is contained even now the whole future, determined in minutest detail both as to character and as to occurrence.

When these implications begin to take hold of one, interest somehow seems to shift from the long-drawn-out process and its unfolding to the formula which implicitly contains the whole. If we choose to use an unphilosophical expression, God has the formula and sees all things as present. Spinoza, who thought much along this line, applied the word eternity to the timelessness of the formula, asserting that "in eternity there is no when, no before, and no after." For him "imagination" may see things *sub duratione,* but "intellect" and "reason" must see them *sub specie æternitatis.* Naturally and necessarily, he goes on to deny any objective reality to contingency or possibility. They exist only relatively to man's ignorance.

But our introduction is, perhaps, already too long. Repeating from the first page, what we wish to establish is that final and exact determination prior to the event is shown only in and for such a closed and finite situation and universe as is substantially different from what science assumes our actual universe to be. In the discussion of this, let us first assume that the situation out of which any event has grown is separable into mathematically distinct elements. Later we shall reject this limitation and repeat in part the consideration.

1. It will be convenient to divide again this case of mathematically distinct elements into two sub-cases, according as the number of elements are or are not numerically infinite.[1] We consider the former first.

(1) The conditions given in this case seem to me to be such as to

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[1] I use the word infinite here and elsewhere throughout the paper, in the mathematical sense, to indicate, that is, such a variable number as may surpass any arbitrarily assigned number, however great.

lead undoubtedly to predeterminism of the complete type. The uniformity of nature, assumed throughout our discussion, can not mean less than that, any set of conditions being given, the next succeeding event is uniquely determined. To fix ideas, let us suppose that the universe, for this case, is composed of exactly six mathematically distinct elements. For my part, I can not but think that mathematics itself, or something very like it, would express for us the whole subsequent history of such a system. An inclusive uniformity of nature would certainly mean that the next succeeding state of affairs would be uniquely fixed in the case of the given simple system of six elements. Whether mathematics would fail, as in the problem of three bodies, to tell us the solution has no bearing on our point. The resulting status would be fixed whether or not we could previse or predict it. And if this would be true, for the next succeeding state of affairs, we have again the discussion of the *S*'s as given above. All succeeding states and movements of the system would be included potentially in the given conditions. All the future of such a system would be included in one formulation. Spinoza's world view would hold. True reason would see things *sub specie æternitatis.*

And if this be true for a system of six elements, it would be quite as true for one of sixty or six thousand or six million. So long as the number of elements is fixed, one all-inclusive formula contains the whole future[2] history of the system.

(2) But if we have an infinite number of elements, the situation appears very different. As I see it, we can not longer say that the conditions which determine any (arbitrarily chosen) event are fixed in advance of the actual eventuation. As this is the crux of the whole argument, we may with propriety dwell on the consideration of this point.

An illustration may help. Consider Halley's comet. The astronomer tells us in justifiable shorthand that this comet will reappear in 1985. Does he mean to assert this absolutely? By no means. Three possible "contingencies" prevent the absolute assertion: (*a*) the calculation may be incorrectly made; (*b*) the data existing within our solar system may not all have been taken into account; (*c*) some additional body, another comet, or a "dead sun" may "enter" our system to disturb the existing conditions. The first two contingencies do not here interest us, the third is vital to our discussion. How shall we deal with it? The astronomer would doubtless say that if only he could have been given, sufficiently in advance, the data of the new body, its effect would have been included, and so we agree. What is then the new situation? The solar system is larger by the new body. The determination in the larger system is exactly as definite as it was in the smaller system, and no more so. The comet is now scheduled for, say, 1990. Will it come on time? Again the same three "contingencies" present themselves. Apparently this method of inquiry leads to an infinite regress.

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[2] Although I have used in this discussion such expressions as *the future, subsequent history, next succeeding,* it is not to be understood that such terms with their ordinary content would be applicable to the assumed system. Their inaptness in the description is a part of the *reductio ad absurdum* of the assumption.

Suppose we take another line of procedure. In the paragraph just concluded we seemed to be asking about foretelling, let us now confine our attention exclusively to fore-determination and ask: At what stage in the comet's history is the date for the next appearing, in fact, determined? Perhaps some more trivial instances may lead us to the answer. One sets an alarm clock to awaken him at six in the morning. The time of its going off is, we say, fixed the night before by the proper adjustment of the machinery. The event is, barring "accidents," determined thus considerably in advance of the eventuation. A miner sets a slow fuse. At what point in the process is the time for the explosion fixed? The structure of the fuse, the length cut off, the general arrangements, the time when the fuse is lit—such are some of the factors that enter into the determination of the event and accordingly of its date. With a modification later to be made, we seem to be authorized to say that as soon as the conditions for an explosion are arranged in place, the time and character of the explosion are fixed. Or more exactly, the results and the time necessary to intervene are fixed, each and all, finally and uniquely, just so soon as the determining conditions are in final and exclusive possession of the field of operations.

But when are the determining conditions in exclusive possession of the field? In the case of the explosion this can only be after the arrangements are made and no outside interference is possible. But with man a factor, the problem takes a turn that we do not care now to follow out. Let us then return to the consideration of the comet. When are the determining factors of its appearing in finally exclusive possession of the field? The terms "determining factors" and "exclusive possession" alike and together point to the same consideration that we had above of possible "additional" elements, with a like fall into the infinite regress. With an infinity[3] to draw from, at any particular instant of time an additional element may "enter" into any assumed system, however large. However large the system be conceived, there is nothing within which shall limit the "determining factors" to the elements already within the system at the given time. Or, to use the other term, never can it be said that finally "exclusive possession" prior to eventuation belongs to any given set of conditions. Since, then, any given system is liable to inference from what is immediately without, no inner determination of the result is final apart from a consideration of what is without; and since on our assumption there is no end to what is without, there is no limit to this ever-widening of the area of determination. The infinite regress that we found previously repeats itself here.

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[3] This is assumed throughout the paper.

2. There remains now for consideration the other case in which we should no longer assume that the determining situation is decomposable into distinct elements. There appears no reason to doubt an equal applicability of the same line of reasoning. In the actual world there is no such separateness and atomism of "things" and "forces" as our vocabulary, following common sense, would imply. But the inaccurate speech so far used does not, I think, take any advantage of the position here controverted. Indeed, in the writer's own experience it was in connection with the more fluid view of things that the position here advocated came to mind.

It may be remarked a certain suspicion naturally, and probably justly, attaches to discussions in which the mathematical infinity plays an important rôle. Zeno and many less capable followers have left the warning sign of danger against this. The writer feels, however, that in the present case he is but tracking the steps of those whose position he attacks; and this to show that it is they, and not he, who have misused the concept. They have found determination to exist antecedent to the fact in certain finite and isolated systems, and have unwarrantably extended that concept to apply to situations infinite in both time and space. The writer's use of the mathematical infinity is but the pointing out of their misuse of it.

The scientific method has been devised with reference to control, and control depends on determination antecedent to the eventuation; but there is here no criticism of the scientific method properly understood. Science takes a world which is (apparently) infinite and not (exactly) decomposable into distinct elements, and by abstraction simplifies this actual world into an ideal world wherein are a finite number of distinct elements. Its conclusions, thus consciously hypothetical, are conditioned always on the assumptions (1) that the situation is adequately analyzed and (2) that all the factors are included. With growth of knowledge comes growth of this ideal world, *i. e.*, more factors are included in the consideration. With each such addition the ideal world accords more nearly with the actual by an amount equal to the influence of the added factor. Always the ideal (for the time being) is finite and accordingly predeterminism does reign in it. But if the actual world be infinite, the addition of factors to the ideal world will be an endless process, and the ideal world can never coincide in all points with the actual.

In conclusion, any event is thus determined to be what it is in every detail by the conditions that are on hand at the time of eventuation. Looking at the present and past, determination is always discernible to appropriate scrutiny. Looking ahead, there is only the approximate determination such as we know in science. To speak absolutely, any event is finally and exactly determined only in the fact of actual eventuation.

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CHANCE AS A CATEGORY OF SCIENCE

TERMS slip easily from popular usage into the technical vocabulary of logic. We often employ the word *chance* as a general synonym of ignorance, while science has accepted a usage which makes chance the antithesis of law. There arises, therefore, the problem of the nature of chance as a category of thought, for upon a distinct and unequivocal interpretation of the term depends alone its legitimate use in science.

There are two possible attitudes we may assume regarding the concept of chance. On the one hand, we may look upon a usage which simply passes over the logical issues and regards chance as merely a shroud for obscuring our veritable ignorance of the true causes of an event. Such a point of view makes chance subjective. On the other hand, we may regard the term as indicating a serviceable, scientific concept, having a significance in the logic of the sciences, a significance which gives chance a distinct and definable value. This point of view makes chance objective.

The usage of chance which makes it depend solely on human ignorance is the immediate postulate of a metaphysical assumption. If we presume, as a fact of reality, that law and order are universal throughout nature, then nothing ever occurs by chance, but is the immediate result of definable laws. If, with this in mind, we speak of the chance occurrence of an event we simply imply that we fail to comprehend the laws upon which the event depends, although we recognize that somewhere in the vast totality of nature's order the event would find an adequate and full explanation. There is no chance from the point of view of the absolute; the postulate of the ultimate uniformity of nature destroys chance with one stroke of the pen and makes all lapse of regularity the lapse of human knowledge.